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How to operate tilapia hatcheries

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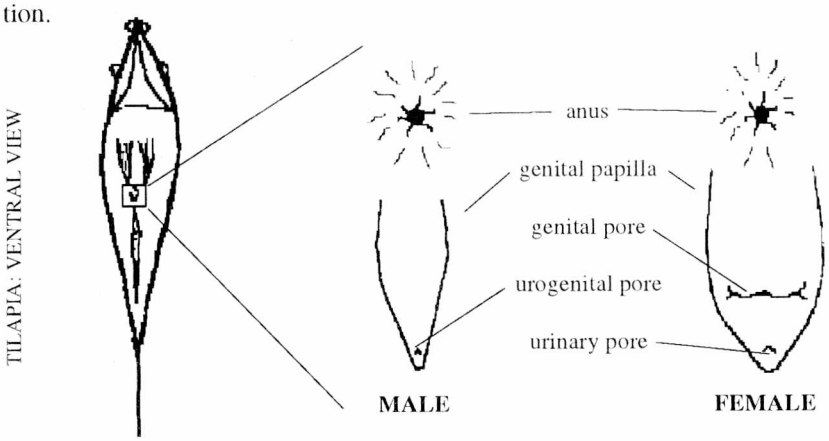
Tilapia hatcheries may be operated in three ways: in concrete tanks, hapa netcages in lakes or in fishponds. Studies have shown that each system yields varying harvests of tilapia fingerlings. A reason for this, according to experts, is the changing water temperature in the holding systems. It is believed that spawning is better in a consistently high temperature (29-31^{o}C) as shown by increased production during the hot or dry season in concrete tanks. In lakes and ponds where netcages may be installed, temperature may vary according to the changing climate, thus, seed production is drastically affected. But even if tanks have higher production than those in ponds and cages, the tilapia species used will still make the difference.

Breeding tilapias

Hatchery operations can be successful if a thorough understanding of the characteristics of the breeders and the breeding process (mating and spawning) is understood.

Physical characteristics

The female tilapia is smaller (more or less 9 cm at age 3 months) than the male. The male (more or less 11 cm at 3 months) has a more pronounced coloration during the mating period. The following illustration shows the genital papilla of both male and female tilapia to help in proper identification.



Tilapias sexually mature in three months; females may spawn from 100 to thousands of eggs, depending on its size. Generally tilapias spawn in shallow portions of lakes, rivers or ponds (0.15-0.80 m deep). In breeding, the male builds nests on the bottom to attract females. The nests are round and shallow, about 20-25 cm wide. The male waits for the female partner in these nests. After a brief courtship (to last a few hours), eggs are spawned by the female and fertilized by milt from the male. The female then gathers the fertilized eggs in its mouth to incubate them. The eggs hatch after 3 days. Spawning can occur as often as twice a month during the year if conditions warrant.

Tilapia breeding in ponds

1. Prepare the pond
   Level the pond bottom and rid it of unwanted organisms by using chemicals or tobacco dust, rotenone, etc. The pond bottom must slope to facilitate water drainage through an outlet pipe or gate.
2. Fix the acidity of the pond (pH 6.5 - 9) by liming (if needed). Amount of lime is usually 1,000 kg per hectare.
3. Fertilize the pond bottom. Use 50 - 100 kg per ha commercial and 1,000 - 2,000 kg per ha organic fertilizers. Anyone of these commercial fertilizers may be used: urea (46-0-0), ammonium sulfate, super phosphate (20% P_2O_3), and triple phosphate (40% P_2O_3). Organic fertilizers are excreta of chicken, swine, cattle, etc.
4. Allow water into the pond to a depth of 2 cm for the first 3 days and wait for the algae to bloom. Add more water (0.75 to 0.80 m).
5. Place 1 male and 3 female tilapias for every square meter of the pond. For a pond 500 m^2, put 1,500 female and 500 male.
6. Weigh 50 fish to estimate the amount of food daily. Only 3% of the total body weight of the breeders must be given as supplemental feed. If natural food is sufficient, supplemental feed must be reduced accordingly.
7. Within 2-3 weeks, watch for schools of fry along the edge of the breeding pond morning and afternoon. Collect them with a fine scoop net and place them in net cages for conditioning at 500 - 1,000 per m^2.
8. After 6 weeks, collect the breeders and place them separately in net cages. This is the time for conditioning the breeders for 1 to 2 weeks. The females are fed a high - protein diet (25% crude protein) in preparation for the next cycle. Dry the pond and clear them of left-over fingerlings.

Tilapia breeding in tanks

1. Place 4 breeders (3 female, 1 male) for every square meter tank. Fill tanks with water to a depth of 0.5 meter.
2. Give artificial feed. Sample 20 fish to calculate the daily feed ration as:

   amount of feed per ration = *total fish body weight* x 0.02

   (To come up with 20% of total fish biomass. Feed is given 2x a day).

The recommended amount of artificial feed for tilapia breeders should contain 40% dietary protein to ensure high fry production.

3. After 2-3 weeks, inspect for the presence of schooling fry. If fry are present, drain tanks by removing the drain pipe. This will allow the breeders and fry to swim to the catch basin. Scoop out the fry before collecting the breeders one by one. Open the mouth of each breeder to make sure that all of the fry are removed from the mouth.
4. Place male and female breeders in separate tanks and condition them for 1-2 weeks for the next breeding cycle.

Tilapia netcage breeding

1. Fine mesh netcages may be used for tilapia hatcheries. These measure 1.5 x 1 x 1 m to 12 x 4 x 2.5 m and installed in ponds, tanks, or lagoons. The cages are made of polyethylene netting (0.6 millimeter) and are installed by hitching them to poles driven into the substratum of ponds.
2. Place selected breeders (50 - 250 g) at a density of 2-4 per square meter and sex ratio of one male to two, or three females. Give supplemental feed (3% of total weight or fish biomass) in a manner as in tanks.
3. After 3 weeks, watch for presence of fry in the net.
4. Fry produced in the cages are collected by scooping them from the inside or lifting up the bottom. Take care not to disturb the fish. If scooping is finished, repeatedly lift and submerge the net in water to allow the breeders to put out fry still left in the mouth. If breeders have already been transferred, gather the remaining fry.

Grading and counting of fry

Fry are separated from fingerlings by allowing the smaller fish to pass through a 3-mm mesh net. Fingerlings are sorted using a series of nets with varying sizes. The table shows the mesh sizes corresponding with the cage of fry-fingerlings.

Net type[a]	Mesh size (mm)	Fry age[b] (days)	Fingerlings (days)
Hapa	0.6	1-7	
#38	.1	8-14	
#24	3		15-21
#22	5		22-28
#17	10		29-36
#14	15		37-42

[a]number of meshes per 15-cm length of net.
[b]Age starting from release of female.

Production of all-male tilapias for grow-out

Monosex culture of tilapia has been recognized as the most effective solution to the problem of early sexual maturation and uncontrolled reproduction. This has been achieved by manual sexing, direct hormonal sex reversal, hybridization, and genetic manipulation.

Manual sexing

In manual sexing, tilapias must be big enough (25 g or more). This method is too tedious and subject to human error. (Please refer to illustration on page 20).

Direct hormonal sex reversal

This has been done by feeding of synthetic male hormones such as methyltestosterone to sexually undifferentiated fry of mouthbrooding tilapias. In commercial practice, fry 9-11 mm long and 10-12 days old are sex-reversed in nursery units with a diet 30-60 mg of the hormone per kg of feed.

In hapas, fry are stocked at 250-1,000 per m^2 and fed hormone diet for 3 weeks at feeding rates of 10-30% body weight per day.

Hybridization of tilapias

Production of all-male fingerlings is done by mating two species with the appropriate sex-determining mechanisms or sex chromosomes. Crossing the female *O. niloticus* with *O. honorum* for example, gives 100% male offspring. This is because the female tilapia has the XX chromosomes while the male has ZZ chromosomes (XZ individuals or hybrids are males).

Genetic manipulation

Mass production of YY-male tilapia through a combination of sex reversal and breeding techniques has also been achieved. Known as the GMT (genetically male tilapia), YY males are produced by treating the tilapia fry with female hormone to obtain XY female which are then bred with normal males to get YY male offspring. All male stocks are produced by breeding XY males with normal female.

Commercial production of all male tilapias, however, are limited by the need for facilities to maintain the "purity" of the line and the low production of young due to incompatibility of the species. To date, hatcheries wanting to produce all-male tilapias hybrid have to be issued license to ensure that methodologies are strictly followed.

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